

CLAIMS

1. A method of introducing impurity; wherein, in the course of introducing a material to a solid substance which has an oxidized film or other film sticking on the surface,
5 the oxidized film and other film are first removed as the surface treatment to the solid substance with at least one means selected from among the group consisting of a means for irradiating the surface of solid substance with plasma, a means for irradiating the surface of solid substance with gas and a means for dipping the surface of solid substance in a reductive liquid, and then
 a certain desired particle is attached or introduced.
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2. The method of introducing impurity recited in claim 1, wherein
 the plasma is that of a rare argon gas, or a system containing hydrogen.
3. The method of introducing impurity recited in claim 1, wherein
15 the gas is that of a system containing hydrogen.
4. The method of introducing impurity recited in claim 1, wherein
 the reductive liquid is at least one item selected from among the group consisting of hydrogen fluoride, sodium hydroxide, aqueous ammonia, sulfinic acid and adipic acid di-2-ethylhexyl ester, etc.
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5. The method of introducing impurity recited in claim 1, wherein
 the means for dipping the surface of solid substance in a reductive liquid rubs the surface of solid substance mechanically when it is dipped in the reductive liquid.
- 25 6. The method of introducing impurity recited in claim 1, wherein
 the certain desired particle is attached or introduced by bringing a gas containing the certain desired particle to make contact to the surface of solid substance which surface has been made to be free

of the oxidized film and other film, thereby the particle is attached or introduced to the surface, or the vicinity, of solid substance.

7. The method of introducing impurity recited in claim 1, wherein

5 the certain desired particle is attached or introduced by irradiating the surface of solid substance, which surface has been made to be free of the oxidized film and other film, with electromagnetic wave whose energy is matching the energy that is binding the hydrogen or hydroxyl radical sticking on the surface with the atom of solid substance, thereby converting the binding into a non-coupled state, separating the sticking hydrogen or hydroxyl radical, and exposing the atom
10 constituting solid substance to the surface; and then introducing the certain desired particle for making contact so that the particle is attached or introduced to the surface, or the vicinity, of solid substance.

8. The method of introducing impurity recited in claim 7, wherein

 the energy of irradiating electromagnetic wave is stronger than 318 kJ/mol, not stronger than
15 666 kJ/mol.

9. The method of introducing impurity recited in claim 8, wherein

 the energy of irradiating electromagnetic wave corresponds to 425 kJ/mol or higher.

20 10. The method of introducing impurity recited in claim 1, wherein

 the attaching or introducing of a certain desired particle is conducted in an environment in which the temperature of solid substance is lower than 600 °C.

11. A method of introducing impurity; wherein, in the course of introducing a material in the phase of
25 ion, plasma, gas, etc. to a solid substance which has an oxidized film or other film sticking to the surface, the oxidized film and other film are first removed as the surface treatment to solid substance with at least one means selected from among the group consisting of a means for irradiating the surface

of solid substance with plasma, a means for irradiating the surface of solid substance with gas and a means for dipping the surface of solid substance in a reductive liquid, and then
a certain desired particle is attached or introduced.

5 12. The method of introducing impurity recited in claim 1, wherein

the certain desired particle is attached or introduced while it is in either one of the states among plasma, gas and ultra low-energy ion.

13. The method of introducing impurity recited in claim 1, wherein

10 at least one facility selected from among each of the following respective categories is used; at least one apparatus selected from among the group consisting of an apparatus for irradiating the surface of solid substance with plasma, an apparatus for irradiating the surface of solid substance with gas and an apparatus for dipping the surface of solid substance in a reductive liquid; an apparatus for bringing a gas containing a certain desired particle to the surface of solid substance; and an annealing apparatus for
15 diffusing the certain desired particle attached or introduced therein.

14. The method of introducing impurity recited in claim 13, wherein

the apparatus for dipping the surface of solid substance in a reductive liquid is provided with a mechanism for rubbing the surface of solid substance mechanically.

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15. The method of introducing impurity recited in claim 13, wherein

the apparatus for bringing a gas containing a certain desired particle to the surface of solid substance is provided with a mechanism for irradiating electromagnetic wave whose energy is matching the energy that is binding the hydrogen or hydroxyl radical sticking on the surface of solid substance,
25 which surface has been made to be free of the oxidized film and other film, with the atom of solid substance.

16. The method of introducing impurity recited in claim 13, wherein

at least two items selected from among the following categories are used in a combination mode or as an integration; at least one apparatus selected from among the group consisting of an apparatus for irradiating the surface of solid substance with plasma, an apparatus for irradiating the surface of solid substance with gas and an apparatus for dipping the surface of solid substance in a reductive liquid; an apparatus for bringing a gas containing a certain desired particle to make contact with the surface of solid substance; and an annealing apparatus for diffusing the certain desired particle attached or introduced therein.

17. An active component device and a passive component device manufactured in accordance with the method of introducing impurity recited in claim 1 or claim 11.

18. An apparatus for introducing impurity; wherein, in the course of introducing a material to a solid substance which has an oxidized film or other film sticking on the surface,

the oxidized film and other film are first removed as the surface treatment to the solid substance with at least one means selected from among the group consisting of a means for irradiating the surface of solid substance with plasma, a means for irradiating the surface of solid substance with gas and a means for dipping the surface of solid substance in a reductive liquid, and then a certain desired particle is attached or introduced.

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19. The apparatus for introducing impurity recited in claim 18, wherein

the plasma is that of a rare argon gas, or a system containing hydrogen.

20. The apparatus for introducing impurity recited in claim 18, wherein

the gas is that of a system containing hydrogen.

21. The apparatus for introducing impurity recited in claim 18, wherein

the reductive liquid is at least one item selected from among the group consisting of hydrogen fluoride, sodium hydroxide, aqueous ammonia, sulfinic acid and adipic acid di-2-ethylhexyl ester, etc.

22. The apparatus for introducing impurity recited in claim 18, wherein

5 the means for dipping the surface of solid substance in a reductive liquid rubs the surface of solid substance mechanically when it is dipped in the reductive liquid.

23. The apparatus for introducing impurity recited in claim 18, wherein

10 the method of attaching or introducing a certain desired particle is bringing a gas containing a certain desired particle to make contact to the surface of solid substance, which surface has been made to be free of the oxidized film and other film, thereby attaching or introducing the particle to the surface, or the vicinity, of solid substance.

24. The apparatus for introducing impurity recited in claim 18, wherein

15 the method of attaching or introducing a certain desired particle is irradiating the surface of solid substance, which surface has been made to be free of the oxidized film and other film, with electromagnetic wave whose energy is matching the energy that is binding the hydrogen or hydroxyl radical sticking on the surface with the atom of solid substance, thereby converting the binding into a non-coupled state, separating the sticking hydrogen or hydroxyl radical, and exposing the atom
20 constituting solid substance to the surface; and then introducing the certain desired particle to make contact so that the particle is attached or introduced to the surface, or the vicinity, of solid substance.

25. The apparatus for introducing impurity recited in claim 24, wherein

25 the energy of irradiating electromagnetic wave is stronger than 318 kJ/mol, not stronger than 666 kJ/mol.

26. The apparatus for introducing impurity recited in claim 25, wherein

the energy of irradiating electromagnetic wave corresponds to 425 kJ/mol or higher.

27. The apparatus for introducing impurity recited in claim 18, wherein

the attaching or introducing of a certain desired particle is conducted in an environment in
5 which the temperature of solid substance is lower than 600 °C.

28. An apparatus of introducing impurity; wherein, in the course of introducing a material in the phase
of ion, plasma, gas, etc., to a solid substance which has an oxidized film or other film sticking to the
surface,

10 the oxidized film and other film are first removed as the surface treatment to solid substance
with at least one means selected from among the group consisting of a means for irradiating the surface
of solid substance with plasma, a means for irradiating the surface of solid substance with gas and a
means for dipping the surface of solid substance in a reductive liquid, and then
a certain desired particle is attached or introduced.

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29. The apparatus for introducing impurity recited in claim 18, wherein

the certain desired particle is attached or introduced while it is in either one of the states among
plasma, gas and ultra low-energy ion.

20 30. The apparatus for introducing impurity recited in claim 18, wherein

at least one facility selected from among each of the following respective categories is used; at
least one apparatus selected from among the group consisting of an apparatus for irradiating the surface
of solid substance with plasma, an apparatus for irradiating the surface of solid substance with gas and an
apparatus for dipping the surface of solid substance in a reductive liquid; an apparatus for bringing a gas
25 containing a certain desired particle to the surface of solid substance; and an annealing apparatus for
diffusing the certain desired particle attached or introduced therein.

31. The apparatus for introducing impurity recited in claim 30, wherein

the apparatus for dipping the surface of solid substance in a reductive liquid is provided with a mechanism for rubbing the surface of solid substance mechanically.

5 32. The apparatus for introducing impurities recited in claim 30, wherein

the apparatus for bringing a gas containing a certain desired particle to the surface of solid substance is provided with a mechanism for irradiating electromagnetic wave whose energy is matching the energy that is binding the hydrogen or hydroxyl radical sticking on the surface of solid substance, which surface has been made to be free of the oxidized film or other film, with the atom of solid
10 substance.

33. The apparatus for introducing impurity recited in claim 30, wherein

at least two items selected from among the following categories are used in a combination mode or as an integration; at least one apparatus selected from among the group consisting of an
15 apparatus for irradiating the surface of solid substance with plasma, an apparatus for irradiating the surface of solid substance with gas and an apparatus for dipping the surface of solid substance in a reductive liquid; an apparatus for bringing a gas containing a certain desired particle to make contact with the surface of solid substance; and an annealing apparatus for diffusing the certain desired particle attached or introduced therein.

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34. An impurity-containing component device manufactured through a procedure; wherein, in the course of introducing a material to a solid substance which has an oxidized film or other film sticking on the surface,

the oxidized film and other film are first removed as the surface treatment to the solid
25 substance with at least one means selected from among the group consisting of a means for irradiating the surface of solid substance with plasma, a means for irradiating the surface of solid substance with gas and a means for dipping the surface of solid substance in a reductive liquid, and then

a certain desired particle is attached or introduced.

35. The impurity-containing component device recited in claim 34, wherein
the plasma is that of a rare argon gas, or a system containing hydrogen.

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36. The impurity-containing component device recited in claim 34, wherein
the gas is that of a system containing hydrogen.

37. The impurity-containing component device recited in claim 34, wherein
10 the reductive liquid is at least one item selected from among the group consisting of hydrogen
fluoride, sodium hydroxide, aqueous ammonia, sulfinic acid and adipic acid di-2-ethylhexyl ester, etc.

38. The impurity-containing component device recited in claim 34, wherein
the means for dipping the surface of solid substance in a reductive liquid rubs the surface of
15 solid substance mechanically when it is dipped in the reductive liquid.

39. The impurity-containing component device recited in claim 34, wherein
the method of attaching or introducing a certain desired particle is bringing a gas containing a
certain desired particle to make contact to the surface of solid substance, which surface has been made to
20 be free of the oxidized film and other film, thereby attaching or introducing the particle to the surface, or
the vicinity, of solid substance.

40. The impurity-containing component device recited in claim 34, wherein
the method of attaching or introducing a certain desired particle is irradiating the surface of
25 solid substance, which surface has been made to be free of the oxidized film and other film, with
electromagnetic wave whose energy is matching the energy that is binding the hydrogen or hydroxyl
radical sticking on the surface with the atom of solid substance, thereby converting the binding into a

non-coupled state, separating the sticking hydrogen or hydroxyl radical, and exposing the atom constituting solid substance to the surface; and then introducing the certain desired particle for making contact so that the particle is attached or introduced to the surface, or the vicinity, of solid substance.

5 41. The impurity-containing component device recited in claim 40, wherein
the energy of irradiating electromagnetic wave is stronger than 318 kJ/mol, not stronger than 666 kJ/mol.

42. The impurity-containing component device recited in claim 41, wherein
10 the energy of irradiating electromagnetic wave corresponds to 425 kJ/mol or higher.

43. The impurity-containing component device recited in claim 34, wherein
the attaching or introducing of a certain desired particle is conducted in an environment in which the temperature of solid substance is lower than 600 °C.

15 44. An impurity-containing component device manufactured through a procedure; wherein, in the course of introducing a material in the phase of ion, plasma, gas, etc. to a solid substance which has an oxidized film or other film sticking to the surface,
the oxidized film and other film are first removed as the surface treatment to solid substance
20 with at least one means selected from among the group consisting of a means for irradiating the surface of solid substance with plasma, a means for irradiating the surface of solid substance with gas and a means for dipping the surface of solid substance in a reductive liquid, and then
a certain desired particle is attached or introduced.

25 45. The impurity-containing component device recited in claim 40, wherein
a certain desired particle is attached or introduced while it is in either one of the states among plasma, gas and ultra low-energy ion.

46. The impurity-containing component device recited in claim 40 manufactured on an apparatus, which apparatus including at least one facility selected from among each of the following respective categories; at least one apparatus selected from among the group consisting of an apparatus for
5 irradiating the surface of solid substance with plasma, an apparatus for irradiating the surface of solid substance with gas and an apparatus for dipping the surface of solid substance in a reductive liquid; an apparatus for bringing a gas containing a certain desired particle to the surface of solid substance; and an annealing apparatus for diffusing the certain desired particle attached or introduced therein.
- 10 47. The impurity-containing component device recited in claim 46, wherein
the apparatus for dipping the surface of solid substance in a reductive liquid is provided with a mechanism for rubbing the surface of solid substance mechanically.
48. The impurity-containing component device recited in claim 46, wherein
15 the apparatus for bringing a gas containing a certain desired particle to the surface of solid substance is provided with a mechanism for irradiating electromagnetic wave whose energy is matching the energy that is binding the hydrogen or hydroxyl radical sticking on the surface of solid substance, which surface has been made to be free of the oxidized film and other film, with the atom of solid substance.
- 20 49. The impurity-containing component device recited in claim 46 manufactured on an apparatus, which apparatus including at least two items selected from the following categories in a combination mode or as an integration; at least one apparatus selected from among the group consisting of an apparatus for irradiating the surface of solid substance with plasma, an apparatus for irradiating the
25 surface of solid substance with gas and an apparatus for dipping the surface of solid substance in a reductive liquid; an apparatus for bringing a gas containing a certain desired particle to make contact with the surface of solid substance; and an annealing apparatus for diffusing the certain desired particle

attached or introduced therein.